



## Anhydrite in Nova Scotia *geofacts*

Nova Scotia Department of Natural Resources  
Mineral Resources Branch  
Information Circular ME 31, 1992

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## Introduction

The gypsum has been mined and the surface mine lies idle. Yet at the bottom of the quarry lies a blueish-grey rock that is an important resource. It is anhydrite (calcium sulphate, or  $\text{CaSO}_4$ ), a common rock mineral.

**Anhydrite** ( $\text{CaSO}_4$ ) is from the Greek word meaning without water.

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### Physical Properties

1. *Hardness - 3 - 3.5*
2. *Specific gravity - 2.89 - 2.98*
3. *Luster - vitreous to pearly on cleavage*
4. *Colour - bluish or violet. Also may be white or tinged with rose, brown or red*
5. *Texture - usually massive*

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## Geology

Nova Scotia's major anhydrite resources are located on the northern mainland and Cape Breton Island in a geological unit called the Windsor Group. These deposits were created 350 to 335 million years ago, when the existing hot, dry climate caused evaporation of the water in an inland sea, making it grey "salty". Large amounts of gypsum and anhydrite (calcium sulphate), salt, (halite-sodium chloride), and limestone (calcium carbonate) as well as some potash (sylvite-potassium chloride) precipitated from the dense "salty" sea water. The arid climate and precipitation resulted in the huge deposits of evaporates that are mined in many parts of Nova Scotia today.

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## Uses

Anhydrite currently has several uses. As a soil conditioner and fertilizer, anhydrite is used to neutralize saline soils, improve the permeability of clayey soil, and add sulphur and calcium. It is commonly used in peanut farming in the southeastern United States. Another major application is as a "set retarder" in Portland cement. A small amount of anhydrite added to cement slows down its setting rate without decreasing its strength.

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## History

Nova Scotia possesses immense deposits of anhydrite, far surpassing gypsum reserves; but, due to low demand, anhydrite has historically been largely regarded as an unwelcome intruder into gypsum production. Numerous gypsum quarries have closed when operations struck the underlying anhydrite.

Nova Scotia's anhydrite has long been produced and sold as an economical gypsum substitute in the cement and soil conditioner markets. Production increased significantly in the 1960s when the Fundy Gypsum Company installed special facilities to separate anhydrite from gypsum at its quarry near Windsor in Hants County. The Gypsum/Anhydrite Project, a Nova Scotia Department of Natural Resource (DNR) effort, initiated in June 1985, identified development of alternate uses for anhydrite and gypsum as one of its goals. Research undertaken by DNR and the Technical University of Nova Scotia (TUNS) investigated several ways to develop a wider anhydrite market.

Although anhydrite's chemical composition makes it unsuitable as a gypsum substitute in plaster of Paris and wallboard, anhydrite-based smooth-surfaced cements have long been used in Germany as a construction material in mines. This durable material is used to support mine roofs, to fill in ceiling cavities, and to construct barrier walls that prevent airflow between working and inactive areas of mines. In 1987, TUNS and DNR began research into using locally produced anhydrite from Little Narrows in Cape Breton's Sydney Basin coal mines.

In mining applications, crushed anhydrite is mixed with water and a chemical hardening "accelerator" to speed up water absorption, then blown into place with compressed air. The material sets similarly to cement, and is much harder and stronger than plaster of Paris. In June 1989, Cape Minerals Ltd. conducted surface trails of anhydrite roof support at Port Edward, Cape Breton County, using anhydrite from the Little Narrows Gypsum Company quarry at Little Narrows, Victoria County. Based on the encouraging results of these trails, the Cape Breton Development Corporation scheduled underground tests. Successful development of this technology could reduce or eliminate the need for costly and flammable wooden pit props in the Cape Breton coal mines.

Anhydrite is also being tested for other uses in the construction industry. Finely crushed anhydrite is mixed into a slurry with hardening accelerators, additives and water to facilitate flow and levelling, then poured onto a rough surface. The slurry, used as a finishing surface, levels and smooths out by itself, eliminating the polishing that concrete requires. Research into these and many other applications continues.

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## Current Production

Currently, two companies produce anhydrite in the Province. In Hants County, the Fundy Gypsum Company produces anhydrite (along with gypsum) at its Wentworth Creek quarry near Windsor, shipping the material to export markets via Hantsport. In 1994, production totalled 66 000 t. On Cape Breton Island, the Little Narrows Gypsum Company's anhydrite quarry produced 109 000 tonnes in 1994, shipping via St. Patrick's Channel in the Bras d'Or Lakes. Little Narrows also supplies anhydrite for the surface and underground trials under way in the Sydney Basin area.

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## Mining and Processing

At Fundy Gypsum, gypsum and anhydrite are blasted and crushed together to pieces less than six inches in size. They are then separated in a heavy media separator, where the particles of rock are added to a solution of water, magnetite and ferrosilicon. The fluid mixture is passed down a spiral conveyor; during this process, the anhydrite sinks and the gypsum floats.

At Little Narrows Gypsum, the gypsum and anhydrite are blasted and crushed separately. The gypsum usually overlies the anhydrite and they are mined separately. Prior to shipping, both commodities are crushed independently to various sizes then sorted or blended to meet the customer's specifications.

At each location the company will crush the anhydrite to meet the customer's requirements. The order then is shipped to the customer by boat, rail or truck.

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## Economic Significance

Anhydrite is still relatively minor importance in the Nova Scotia mineral industry. Anhydrite quarried in the province in 1994 had a total value just over \$2 million. Current anhydrite production levels are roughly the same as those for gypsum at the beginning of this century, when gypsum's uses were basically the same as anhydrite's are today. Ongoing research may, however, enlarge the market for this abundant resource in the future.

Mining and the mineral industry are an important part of the economy in Nova Scotia. The mineral industry, including people and companies who explore for minerals, mine them, and manufacture mineral-based products, create wealth and employment. More than 11,000 people are employed directly or indirectly in mining related work. Mining companies pay taxes to several levels of government and royalties to the provincial government. All of the mineral exploration activity and most of the mining operations are located in rural Nova Scotia. Their economic energy creates important local benefits.

In Nova Scotia, the economic benefits of mining are significantly enhanced by the partnership of the federal and provincial governments under various Cooperation Agreements on Mineral Development. Together the two governments are strengthening and promoting the province's mineral industry.

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## Information

For further information on salt in Nova Scotia, please contact:

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### Additional Sources of Information

- *Geological Highway Map of Nova Scotia*, by Howard V. Donohoe and Robert G. Grantham. Atlantic Geoscience Society, 1989. Special Publications Number (Second Edition).
- *Rock Talk: A Guide to Discovering the Geology, Landscapes and Mineral Resources of Nova Scotia*, by Craig K. Miller and G. C. Milligan. Nova Scotia Department of Natural Resources, 1996. Information Circular No. 20.
- *Gypsum and Anhydrite in Nova Scotia*, by G. C. Adams. Nova Scotia Department of Natural Resources, 1993. Information Circular ME 16.
- *Mineral Rights, Landowners, and Mineral Exploration*, by Howard Donohoe. Nova Scotia Department of Natural Resources, 1996. Information Circular ME 2.

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Photos: (Not presently available)

*At Wentworth Creek near Windsor, Fundy Gypsum Company separates anhydrite from gypsum at the loading facility. Both minerals are then transported to Hantsport by rail for shipping to the United States.*

*At Little Narrows on the Bras d'Or Lakes, ocean vessels call at Little Narrows Gypsum Company to load anhydrite and gypsum. The quarry in the background was once a source of ore but is now being reclaimed for other land uses.*

*In the surface mine at Little Narrows, huge D11 Caterpillar bulldozers use a rear "hook" to break up the gypsum and anhydrite without using dynamite.*

*Large ocean going vessels steam up the Avon River with the incoming tide to Hantsport to load anhydrite and gypsum. Within three hours, 30 000 t of ore is loaded and the ship is on its way down stream.*

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Figures: (Not presently available)

*Chart: Anhydrite "cement packs" are used as roof supports instead of wood.*

*Anhydrite - Present production (graph)*

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Map: (Not presently available)

*Anhydrite production.*

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